

# Flute

The **flute** is a family of musical instruments in the woodwind group. Unlike woodwind instruments with reeds, a flute is an aerophone or reedless wind instrument that produces its sound from the flow of air across an opening. According to the instrument classification of Hornbostel–Sachs, flutes are categorized as edge-blown aerophones.<sup>[1]</sup> A musician who plays the flute can be referred to as a flute player, flautist, flutist or, less commonly, fluter or flutenist.



A selection of flutes from around the world

Flutes are the earliest extant musical instruments, as paleolithic instruments with hand-bored holes have been found. A number of flutes dating to about 43,000 to 35,000 years ago have been found in the Swabian Jura region of present-day Germany. These flutes demonstrate that a developed musical tradition existed from the earliest period of modern human presence in Europe.<sup>[2][3]</sup>

## Contents

### Etymology and terminology

### History

### Acoustics

### Categories

- Western transverse flutes
  - Wooden one-keyed transverse flute
  - Western concert flute
  - Western concert flute variants
- Indian flutes
- Chinese flutes
- Japanese flutes
- Sodina and suling
- Sring

### See also

### References

### Bibliography

### External links

## Etymology and terminology

The word *flute* first entered the English language during the Middle English period, as *floute*,<sup>[4]</sup> or else *flowte*, *flo(y)te*,<sup>[5]</sup> possibly from Old French *flaute* and from Old Provençal *flaüt*,<sup>[4]</sup> or else from Old French *fleüte*, *flaüte*, *flahute* via Middle High German *floite* or Dutch *fluit*. The English verb *flout* has the same linguistic root, and the modern Dutch verb *fluiten* still shares the two meanings.<sup>[6]</sup> Attempts to trace the word back to the Latin *flare* (to blow, inflate) have been pronounced "phonologically impossible" or "inadmissible".<sup>[5]</sup> The first known use of the word *flute* was in the 14th century.<sup>[7]</sup> According to the *Oxford English Dictionary*, this was in Geoffrey Chaucer's *The Hous of Fame*, c.1380.<sup>[5]</sup>

Today, a musician who plays any instrument in the flute family can be called a flutist (pronounced "FLEW-tist", most common in the US),<sup>[8]</sup> or flautist (pronounced "FLAW-tist", most common in the UK),<sup>[9]</sup> or simply a flute player (more neutrally). *Flutist* dates back to at least 1603, the earliest quotation cited by the *Oxford English Dictionary*. *Flautist* was used in 1860 by Nathaniel Hawthorne in *The Marble Faun*, after being adopted during the 18th century from Italy (*flautista*, itself from *flauto*), like many musical terms in England since the Italian Renaissance. Other English terms, now virtually obsolete, are *fluter* (15th–19th centuries)<sup>[10][11][12]</sup> and *flutenist* (17th–18th centuries).<sup>[6][13]</sup>

## History

The oldest flute ever discovered may be a fragment of the femur of a juvenile cave bear, with two to four holes, found at Divje Babe in Slovenia and dated to about 43,000 years ago. However, this has been disputed.<sup>[14][15]</sup> In 2008 another flute dated back to at least 35,000 years ago was discovered in Hohle Fels cave near Ulm, Germany.<sup>[16]</sup> The five-holed flute has a V-shaped mouthpiece and is made from a vulture wing bone. The researchers involved in the discovery officially published their findings in the journal *Nature*, in August 2009.<sup>[17]</sup> The discovery was also the oldest confirmed find of any musical instrument in history,<sup>[18]</sup> until a redating of flutes found in Geißenklösterle cave revealed them to be even older with an age of 42,000 to 43,000 years.<sup>[3]</sup>

The flute, one of several found, was found in the Hohle Fels cavern next to the Venus of Hohle Fels and a short distance from the oldest known human carving.<sup>[19]</sup> On announcing the discovery, scientists suggested that the "finds demonstrate the presence of a well-established musical tradition at the time when modern humans colonized Europe".<sup>[20]</sup> Scientists have also suggested that the discovery of the flute may help to explain "the probable behavioural and cognitive gulf between" Neanderthals and early modern human.<sup>[18]</sup>

A three-holed flute, 18.7 cm long, made from a mammoth tusk (from the Geißenklösterle cave, near Ulm, in the southern German Swabian Alb and dated to 30,000 to 37,000 years ago)<sup>[21]</sup> was discovered in 2004, and two flutes made from swan bones excavated a decade earlier (from the same cave in Germany, dated to circa 36,000 years ago) are among the oldest known musical instruments.

A playable 9,000-year-old Gudi (literally, "bone flute") was excavated from a tomb in Jiahu along with 29 defunct twins,<sup>[22]</sup> made from the wing bones of red-crowned cranes with five to eight holes each, in the Central Chinese province of Henan.<sup>[23]</sup> The earliest extant Chinese transverse flute is a *chi* (簫) flute discovered in the Tomb of Marquis Yi of Zeng at the Suizhou site, Hubei province, China. It dates from 433 BC, of the later Zhou Dynasty.<sup>[24]</sup> It is fashioned of lacquered bamboo with closed ends and has five stops that are at the flute's side instead of the top. Chi flutes are mentioned in *Shi Jing*, compiled and edited by Confucius, according to tradition.



Chinese women playing flutes, from the 12th-century Song dynasty remake of the *Night Revels of Han Xizai*, originally by Gu Hongzhong (10th century)

The earliest written reference to a flute is from a Sumerian-language cuneiform tablet dated to c. 2600–2700 BCE.<sup>[25]</sup> Flutes are also mentioned in a recently translated tablet of the Epic of Gilgamesh, an epic poem whose development spanned the period of approximately 2100–600 BCE.<sup>[26]</sup> Additionally, a set of cuneiform tablets known as the "*musical texts*" provide precise tuning instructions for seven scales of a stringed instrument (assumed to be a Babylonian lyre). One of those scales is named **embūbum**, which is an Akkadian word for "*flute*".<sup>[26]</sup>

The Bible, in Genesis 4:21, cites Jubal as being the "father of all those who play the *ugab* and the *kinnor*". The former Hebrew term is believed by some to refer to some wind instrument, or wind instruments in general, the latter to a stringed instrument, or stringed instruments in general. As such, Jubal is regarded in the Judeo-Christian tradition as the inventor of the flute (a word used in some translations of this biblical passage).<sup>[27]</sup> Elsewhere in the Bible, the flute is referred to as "*chalil*" (from the root word for "hollow"), in particular in 1 Samuel 10:5, 1 Kings 1:40, Isaiah 5:12 and 30:29, and Jeremiah 48:36.<sup>[28]</sup> Archeological digs in the Holy Land have discovered flutes from both the Bronze Age (c. 4000-1200 BCE) and the Iron Age (1200-586 BCE), the latter era "witness[ing] the creation of the Israelite kingdom and its separation into the two kingdoms of Israel and Judea."<sup>[27]</sup>

Some early flutes were made out of tibias (shin bones). The flute has also always been an essential part of Indian culture and mythology,<sup>[29]</sup> and the cross flute believed by several accounts to originate in India<sup>[30][31]</sup> as Indian literature from 1500 BCE has made vague references to the cross flute.<sup>[32]</sup>

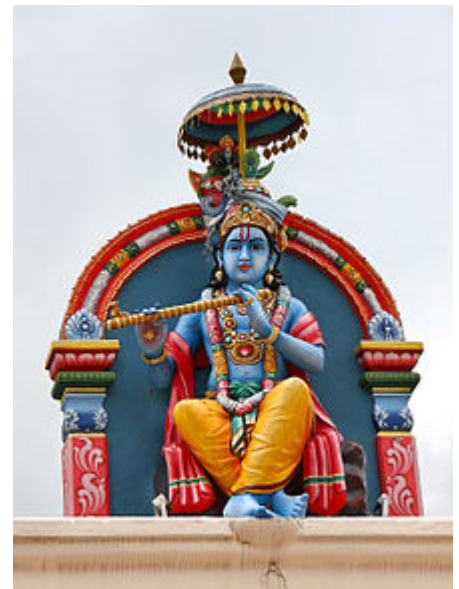
## Acoustics

A flute produces sound when a stream of air directed across a hole in the instrument creates a vibration of air at the hole.<sup>[33][34]</sup> The airstream creates a Bernoulli or siphon. This excites the air contained in the usually cylindrical resonant cavity within the flute. The flutist changes the pitch of the sound produced by opening and closing holes in the body of the instrument, thus changing the effective length of the resonator and its corresponding resonant frequency. By varying the air pressure, a flutist can also change the pitch by causing the air in the flute to resonate at a harmonic rather than the fundamental frequency without opening or closing any holes.<sup>[35]</sup>

Head joint geometry appears particularly critical to acoustic performance and tone,<sup>[36]</sup> but there is no clear consensus on a particular shape amongst manufacturers. Acoustic impedance of the embouchure hole appears the most critical parameter.<sup>[37]</sup> Critical variables affecting this acoustic impedance include: chimney length (hole between lip-plate and head tube), chimney diameter, and radii or curvature of the ends of the chimney and any designed restriction in the "throat" of the instrument, such as that in the Japanese Nohkan Flute.



Panflute players. *Cantigas de Santa Maria*, mid-13th century, Spain



Statue of Krishna playing a flute

A study in which professional flutists were blindfolded could find no significant differences between flutes made from a variety of metals.<sup>[38]</sup> In two different sets of blind listening, no flute was correctly identified in a first listening, and in a second, only the silver flute was identified. The study concluded that there was "no evidence that the wall material has any appreciable effect on the sound color or dynamic range".

## Categories

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In its most basic form, a flute is an open tube which is blown into. After focused study and training, players use controlled air-direction to create an airstream in which the air is aimed downward into the tone hole of the flute's headjoint. There are several broad classes of flutes. With most flutes, the musician blows directly across the edge of the mouthpiece, with 1/4 of their bottom lip covering the embouchure hole. However, some flutes, such as the whistle, gemshorn, flageolet, recorder, tin whistle, tonette, fujara, and ocarina have a duct that directs the air onto the edge (an arrangement that is termed a "fipple"). These are known as **fipple flutes**. The fipple gives the instrument a distinct timbre which is different from non-fipple flutes and makes the instrument easier to play, but takes a degree of control away from the musician.

Another division is between **side-blown** (or **transverse**) flutes, such as the Western concert flute, piccolo, fife, dizi and bansuri; and **end-blown flutes**, such as the ney, xiao, kaval, danso, shakuhachi, Anasazi flute and quena. The player of a side-blown flute uses a hole on the side of the tube to produce a tone, instead of blowing on an end of the tube. End-blown flutes should not be confused with fipple flutes such as the recorder, which are also played vertically but have an internal duct to direct the air flow across the edge of the tone hole.

Flutes may be open at one or both ends. The ocarina, xun, pan pipes, police whistle, and bosun's whistle are closed-ended. Open-ended flutes such as the concert flute and the recorder have more harmonics, and thus more flexibility for the player, and brighter timbres. An organ pipe may be either open or closed, depending on the sound desired.

Flutes may have any number of pipes or tubes, though one is the most common number. Flutes with multiple resonators may be played one resonator at a time (as is typical with pan pipes) or more than one at a time (as is typical with double flutes).

Flutes can be played with several different air sources. Conventional flutes are blown with the mouth, although some cultures use nose flutes. The flue pipes of organs, which are acoustically similar to duct flutes, are blown by bellows or fans.

### Western transverse flutes

#### Wooden one-keyed transverse flute



Playing the *zampoña*, a Pre-Inca instrument and type of pan flute.



Western concert flute

Usually in D, wooden transverse flutes were played in European classical music mainly in the period from the early 18th century to the early 19th century. As such the instrument is often indicated as baroque flute. Gradually marginalized by the Western concert flute in the 19th century, baroque flutes were again played from the late 20th century as part of the historically informed performance practice.

### Western concert flute



An illustration of a Western concert flute

The Western concert flute, a descendant of the medieval German flute, is a transverse treble flute that is closed at the top. An embouchure hole is positioned near the top across and into which the flutist blows. The flute has circular tone holes larger than the finger holes of its baroque predecessors. The size and placement of tone holes, key mechanism, and fingering system used to produce the notes in the flute's range were evolved from 1832 to 1847 by Theobald Boehm and greatly improved the instrument's dynamic range and intonation over its predecessors.<sup>[39]</sup> With some refinements (and the rare exception of the Kingma system and other custom adapted fingering systems), Western concert flutes typically conform to Boehm's design, known as the Boehm system. Beginner's flutes are made of nickel, silver, or brass that is silver-plated, while professionals use solid silver, gold, and sometimes platinum flutes. There are also modern wooden-bodied flutes usually with silver or gold keywork. The wood is usually African Blackwood.

The standard concert flute is pitched in C and has a range of three octaves starting from middle C or one half step lower when a B foot is attached. This means the concert flute is one of the highest common orchestra and concert band instruments.

### Western concert flute variants

The piccolo plays an octave higher than the regular treble flute. Lower members of the flute family include the G alto and C bass flutes that are used occasionally, and are pitched a perfect fourth and an octave below the concert flute, respectively. The contrabass, double contrabass, and hyperbass are other rare forms of the flute pitched two, three, and four octaves below middle C respectively.

Other sizes of flutes and piccolos are used from time to time. A rarer instrument of the modern pitching system is the treble G flute. Instruments made according to an older pitch standard, used principally in wind-band music, include D $\flat$  piccolo, soprano flute (the primary instrument, equivalent to today's concert C flute), F alto flute, and B $\flat$  bass flute.



Center: Piccolo. Right: larger flute

### Indian flutes



A Carnatic eight-holed bamboo flute

The bamboo flute is an important instrument in Indian classical music, and developed independently of the Western flute.

The Hindu God Lord Krishna is traditionally considered a master of the bamboo flute. The Indian flutes are very simple compared to the Western counterparts; they are made of bamboo and are keyless.<sup>[40]</sup>

Two main varieties of Indian flutes are currently used. The first, the Bansuri (बांसुरी), has six finger holes and one embouchure hole, and is used predominantly in the Hindustani music of Northern India. The second, the Venu or Pullanguzhal, has eight finger holes, and is played predominantly in the Carnatic music of Southern India. Presently, the eight-holed flute with cross-fingering technique is common among many Carnatic flutists. Prior to this, the South Indian flute had only seven finger holes, with the fingering standard developed by Sharaba Shastri, of the Palladam school, at the beginning of the 20th century.<sup>[41]</sup>

The quality of the flute's sound depends somewhat on the specific bamboo used to make it, and it is generally agreed that the best bamboo grows in the Nagercoil area of South India.<sup>[42]</sup>

Based on Bharata Natya Shastra Sarana Chatushtai, Avinash Balkrishna Patwardhan in 1998 developed a methodology to produce perfectly tuned flutes for the ten 'thatas' currently present in Indian Classical Music.<sup>[43]</sup>

In a regional dialect of Gujarati, a flute is also called Pavo.<sup>[44]</sup> Some people can also play pair of flutes (Jodiyo Pavo) simultaneously.

## Chinese flutes

In China there are many varieties of dizi (笛子), or Chinese flute, with different sizes, structures (with or without a resonance membrane) and number of holes (from 6 to 11) and intonations (different keys). Most are made of bamboo, but can come in wood, jade, bone, and iron. One peculiar feature of the Chinese flute is the use of a resonance membrane mounted on one of the holes that vibrates with the air column inside the tube. This membrane is called a di mo, which is usually a thin tissue paper. It gives the flute a bright sound.

Commonly seen flutes in the modern Chinese orchestra are the bangdi (梆笛), qudi (曲笛), xindi (新笛), and dadi (大笛). The bamboo flute played vertically is called the xiao (簫), which is a different category of wind instrument in China.

## Japanese flutes

The Japanese flute, called the fue, 笛 (hiragana: ふえ), encompasses a large number of musical flutes from Japan, include the end-blown shakuhachi and hotchiku, as well as the transverse gakubue, komabue, ryūteki, nōkan, shinobue, kagurabue and minteki.



An eight-holed classical Indian bamboo flute.



Temple car carving of Krishna playing flute, suchindram, Tamil Nadu, India

## Sodina and suling

The sodina is an end-blown flute found throughout the island state of Madagascar, located in the Indian Ocean off southeastern Africa. One of the oldest instruments on the island, it bears close resemblance to end-blown flutes found in Southeast Asia and particularly Indonesia, where it is known as the suling, suggesting the predecessor to the sodina was carried to Madagascar in outrigger canoes by the island's original settlers emigrating from Borneo.<sup>[45]</sup> An image of the most celebrated contemporary sodina flutist, Rakoto Frah (d. 2001), was featured on the local currency.<sup>[46]</sup>



A sodina player in Madagascar

## Sring

The sring (also called *blu*) is a relatively small, end-blown flute with a nasal tone quality<sup>[47]</sup> found in the Caucasus region of Eastern Armenia. It is made of wood or cane, usually with seven finger holes and one thumb hole,<sup>[47]</sup> producing a diatonic scale. One Armenian musicologist believes the sring to be the most characteristic of national Armenian instruments.<sup>[48]</sup>

## See also

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- Bansuri
- Flute method
- Diple
- Frula
- Hand flute
- Irish flute
- Jazz flute
- Native American flute
- Palendag
- Pipe and tabor
- Washint
- Pipe (instrument)

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